# Frequency and Timing

- **Overall Objective**
  - –To advance the technologies for generation and transmission of ultra-stable reference signals *and* to perform in-situ calibration of atmospheric phase delay for Ka-band propagation to deep space-craft receivers. These tasks will be carried out to reduce DSN costs and enable new mission types.
  - **–Goals and Products**
  - –Demonstrate world's best long- term (hours to weeks) stability with Linear Ion Trap standards (LITS and LITE).
  - – Demonstrate 10K Compensated Sapphire Oscillator (CSO) to provide ultra-high short-term stability (to a few hundred seconds) with uninterrupted operation.
  - –Develop a tropospheric calibration system based on the water vapor radiometer (WVR) to reduce deep-space Ka-band link noise to below 1.6e-15 to meet Cassini Radio Science requirements.
  - –Develop an analysis methodology and database to enable calculation of tropospheric effects on telemetry, radio-metrics and radio science at all three DSN sites.

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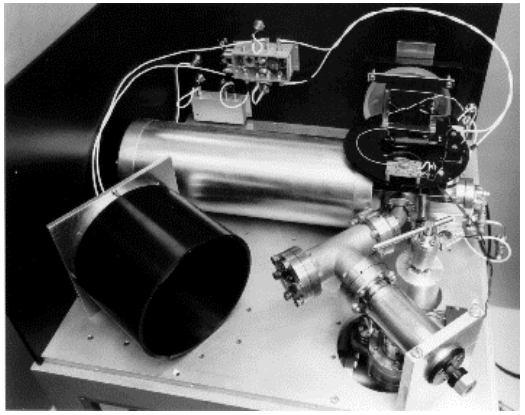
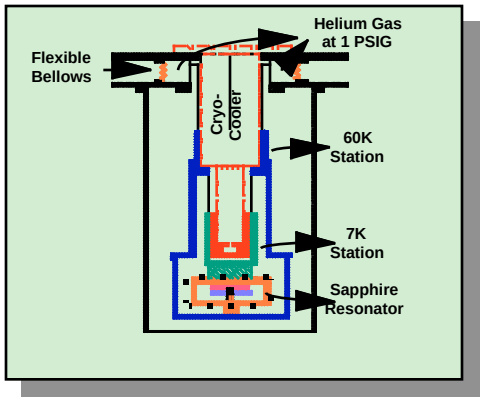


***Extended Linear Ion Trap (LITE)***




***10K Sapphire Oscillator***